13 Pomme de Terre Lake

13.1 General Background

Pomme de Terre Lake was impounded in 1961 and reached full pool in 1963. The main water quality threats to Pomme de Terre Lake are nutrients and bacterial contamination.

13.1.1 Location

Pomme de Terre Lake is located approximately 96 km (60 miles) north of Springfield, Missouri. The dam is located at river km 73 (river mile 45.6) on the Pomme de Terre River. The watershed includes portions of Hickory, Polk, Green and Webster counties. Historic water quality sample sites at Pomme de Terre Lake include 3 lake, 1 outflow, and 2 inflow (Figure 13.1).

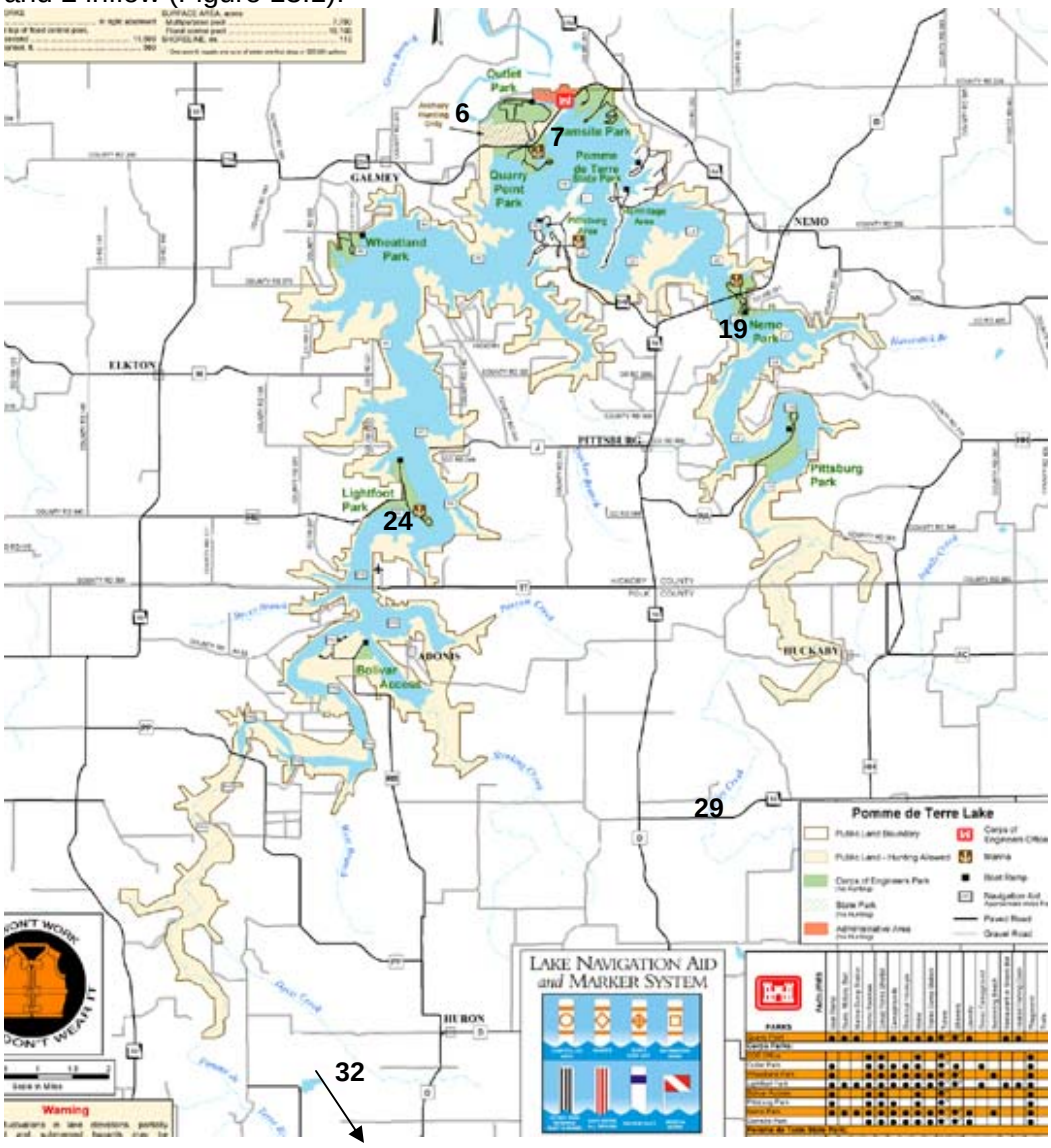

Figure 13.1. Pomme de Terre Lake area map with sample site locations.

13.1.2 Authorized Purposes: Flood control, water quality improvement, supplemental navigation on the lower Missouri and Mississippi Rivers, recreation, and fish and wildlife management.

13.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	874.0	406.9	16,100	
Multipurpose	839.0	237.5	7,820	113
Total		644.4		

Total watershed area: 611 sq miles (391,040 A)

Watershed ratio: 24.3 FC / 50.0 MP

Average Annual Inflow: 367,038 acre-feet
Average Annual outflow: 000 acre-feet
Average flushing rate:
Sediment inflow (measured): 4,358 acre-feet (1961 – 1974)

13.2 2005 Activities

Pomme de Terre Lake was categorized as an 'intensive' lake during 2005, thus samples were collected from two inflow, 3 lake, and one outflow sites. Sample collections occurred from May through September 2005, while vertical profiles (temperature, DO, pH, conductivity, and turbidity) were recorded at the three lake sites from June through September. Pomme de Terre Lake staff (OF-PT) providing field assistance with the WQP during 2005 included Glenn Locke, Jonathan Carlisle, and Dennis Wallace. Jim Davis, former OF-PT Operations Manager, provided technical insight and background knowledge on Pomme de Terre Lake and surrounding watershed.

13.3 2005 Data

Comparative historic data consists of a single sample collected in 2002, three samples (April – July) during 2004 and five monthly (May - September) samples during 2005.

13.3.1 Inflow

Inflow samples were collected from two tributary streams during 2005. These sites are located on the Pomme de Terre River (Site 32) downstream of Bolivar, and the other site (Site 29) is located on Lindley Creek at State Road 64 bridge. All data is discussed in context with lake samples below.

13.3.2 Lake

Based on nutrient concentrations and chlorophyll a values, Pomme de Terre is considered mesotrophic – eurtrophic. Median total nitrogen concentrations range from 0.7 – 1.2 mg/L (Figure 13.2). Although typical of district lakes, these concentrations

exceed EPA's proposed ecoregional nutrient criteria value of 0.46 mg/L TN. Highest TN concentrations were measured from Site 29 (Lindley Creek), which may be indicative of

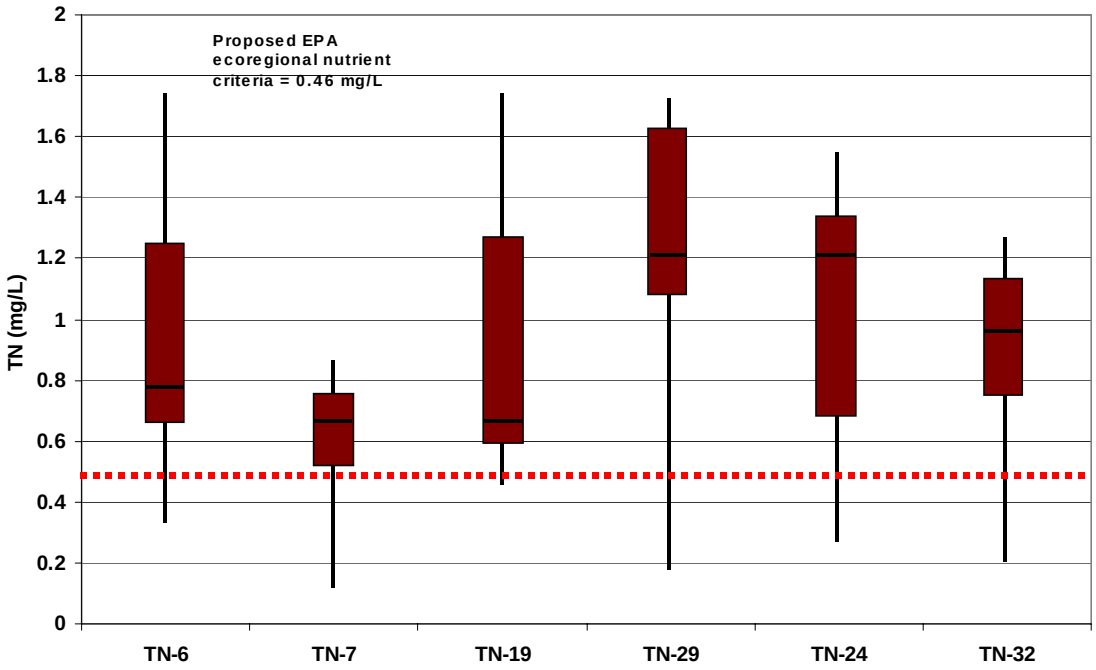

Figure 13.2. Box plots of surface water sample total nitrogen concentrations measured at outflow (TN-6), lake, and inflow (TN-29 & TN-32) sites from 2004 – 2005 at Pomme de Terre Lake.

some landuse activities occurring upstream of the site. Median total phosphorus concentrations (0.06 – 0.14 mg/L), typical for district lakes, are indicative of eutrophic waters (Figure 13.3). These concentrations exceed EPA's proposed ecoregional nutrient criteria value of 0.008 mg/L TP. Inflow TP concentrations were significantly higher than lake sites, indicating opportunities for improvement in landuse practices and nonpoint source nutrient control.

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios $\geq$ 20:1 are indicative of desirable algal communities, whereas ratios $\leq$ 12:1 are indicative of bloom-forming cyanobacteria (blue green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites. Median TN:TP ratios at all three lake sites are < 12, indicating the lake is at risk for cyanobacteria blooms (Figure 13.4). Microcystin toxins have been detected at Pomme de Terre Lake during 2000 (Dr Jennifer Graham, USGS, personal communication).

Mean chlorophyll *a* concentrations ranged from 19 – 28 ug/L between July and September at the three lake sites. These values are indicative of eutrophic waters. Secchi depth measured from July through September indicated water clarity was variable between sites and months (Figure 13.5). The clearest water (1.3 – 2 m) was measured at Site 7 (tower), while moderately clear water was measured near Lightfoot Park (0.7 – 0.8 m) in the Pomme de Terre River arm.

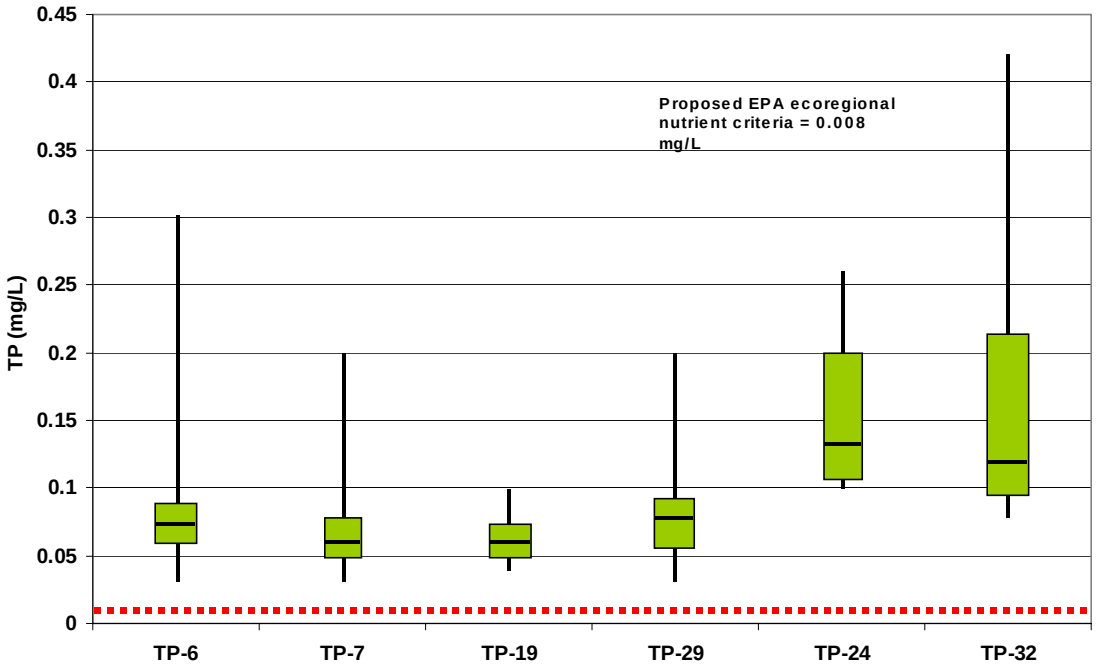

Figure 13.3. Box plots of surface water sample total phosphorus concentrations measured at outflow (TP-6), lake, and inflow (TP-29 & TN-32) sites from 2004 – 2005 at Pomme de Terre Lake.

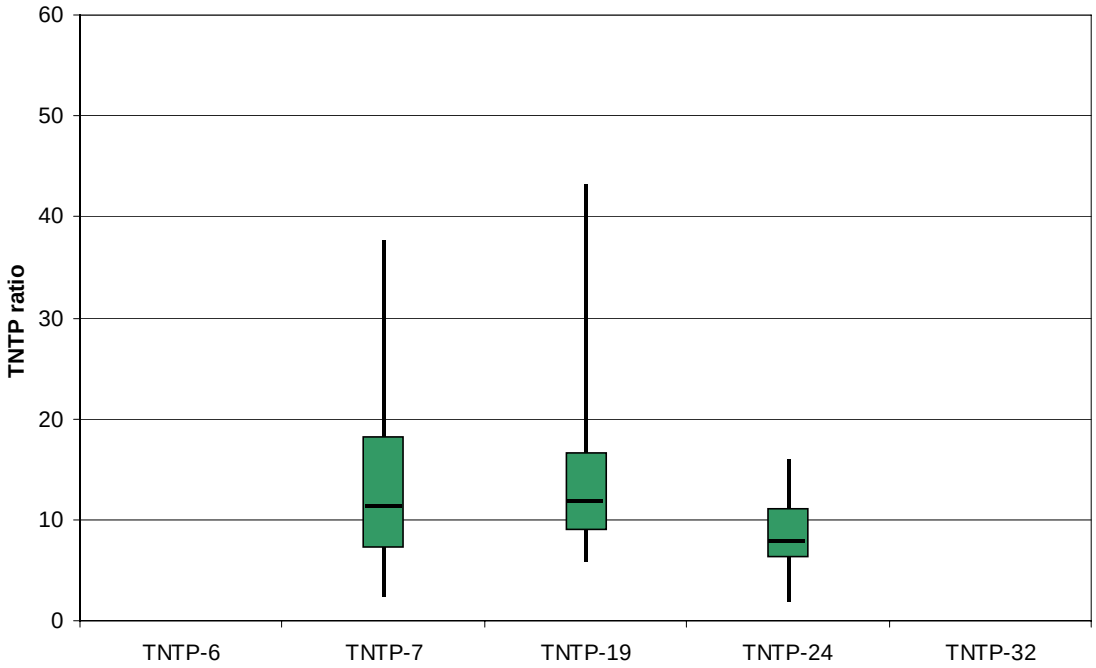

Figure 13.4. Boxplots of total nitrogen : total phosphorus (TN : TP) ratio by site from 2004 – 2005 at Pomme de Terre Lake.

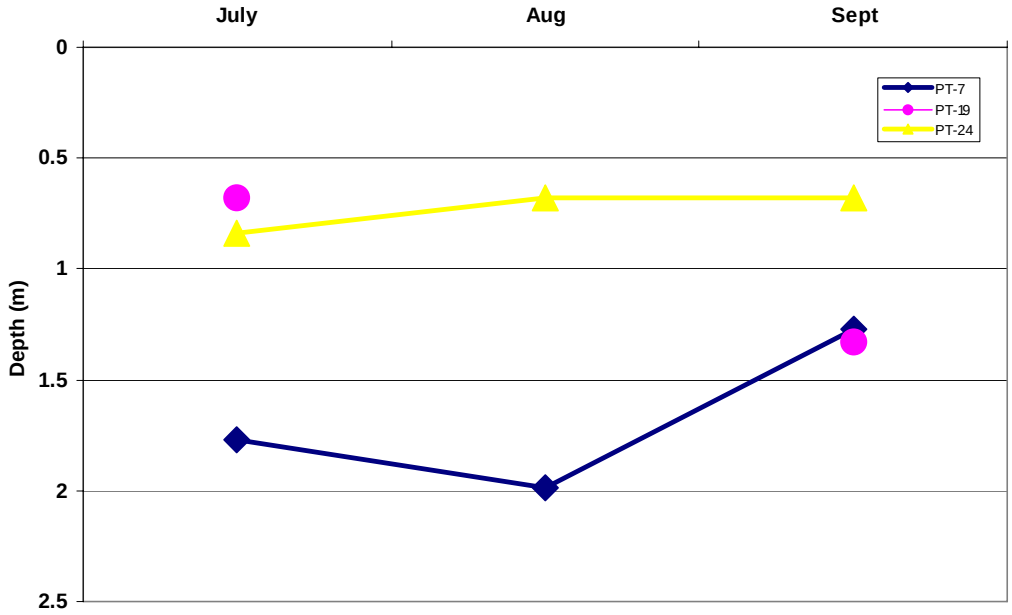

Figure 13.5. Secchi depths measured by site at Pomme de Terre Lake during July, August and September 2005.

Atrazine sample concentrations are consistently less than 0.2 ug/L, which is well below EPA's drinking water maximum contaminant level of 3 ug/L. In addition, all other contaminants (ie., alachlor, metolachlor, cyanazine) monitored during 2004 and 2005 were below detection limits from all three lake sites.

Vertical profiles were recorded during June through September on sampling trips to Pomme de Terre Lake. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on these profiles, the lake stratified both chemically and thermally between 4-5 m depth during July - August (Figure 12.10). The thermocline had extended to nearly 10 m by late September, as the lake water temperatures began to cool and fall turnover was beginning.

Total iron exceeded EPA's Drinking Water Standard of Secondary Maximum Contaminant Levels (SMCL) of 300 ug/L from surface samples collected during August at both inflow sites. Concentrations ranged from 398 – 646 ug/L, with the highest concentration recorded at Site 29 (Lindley Creek). Implications are directed at drinking water facilities related to taste and staining issues. In addition, all surface samples (lake and inflows) collected during August exceeded EPA's SMCL for manganese (50 ug/L). Sample concentrations ranged from 63 – 228 ug/L, with lowest concentrations measured at lake sites. Implications are directed at drinking water facilities due to taste and stain issues.

13.3.3 Outflow

Outfall samples were collected from Pomme de Terre Lake during 2005. All data is discussed in context with the lake samples above.

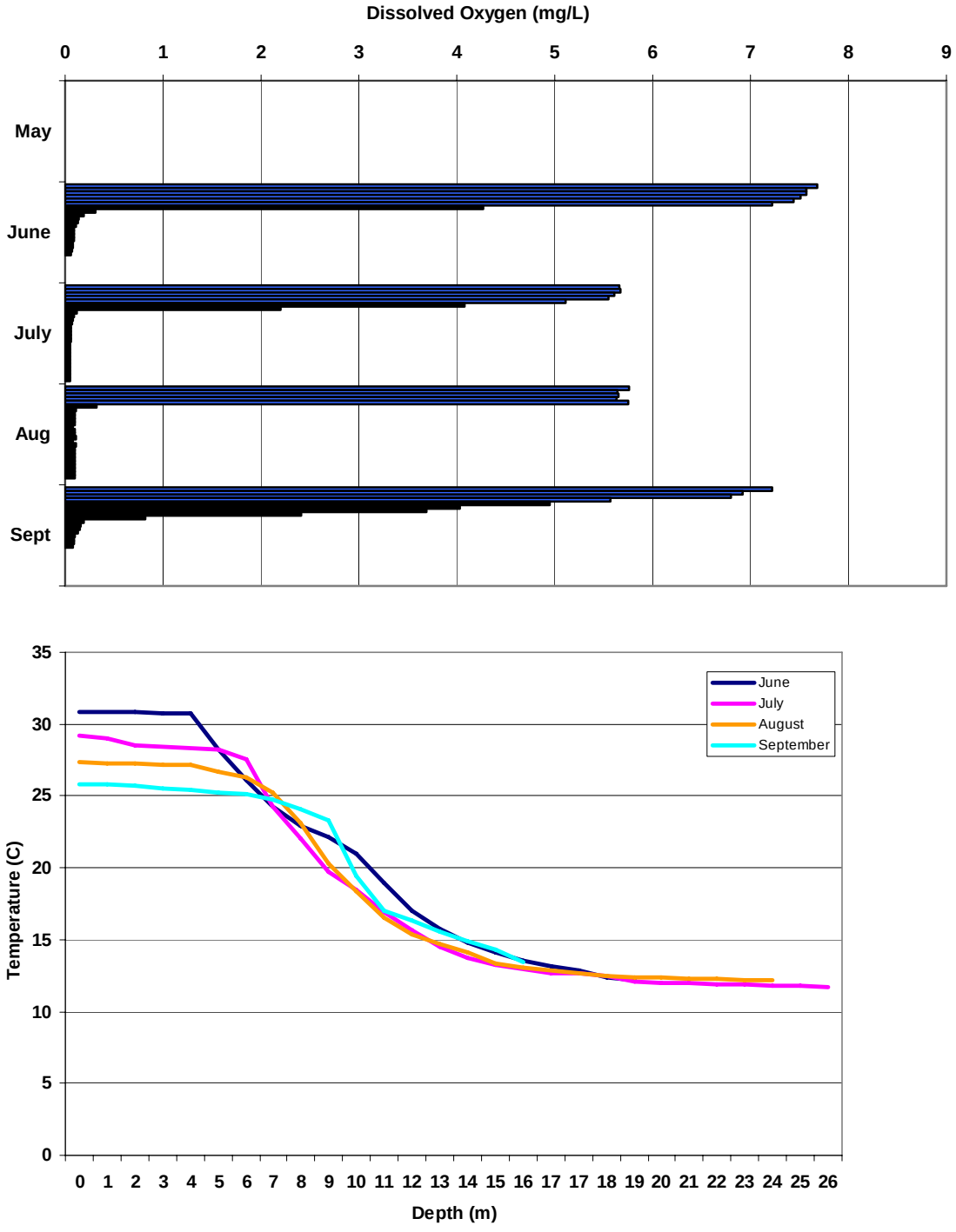

Figure 13.6. Dissolved oxygen concentration (mg/L) histogram and temperature (°C) plot from a vertical profile recorded at Site 7 from June through September 2005.

13.4 Future Activities and Recommendations

Sampling activities for 2006 will include transition from ‘intensive’ to ‘ambient’ monitoring from May through September, as well as conducting at least one summer vertical profile at each of the three lake sites. In addition, a Hach HQ-10 portable temperature – dissolved oxygen meter with 15 m cable was provided for use at the lake to provide more frequent profile data.